MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Draft Regulatory Impact Report (RIR)

10 CSR 20-6.015

No-Discharge Operations and Land Application Requirements

Public Notice

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Missouri Department of Natural Resources

Water Protection Program

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Regulatory Impact Report
10 CSR 20-6.015 No-Discharge Operations and Land Application Requirements

Pursuant to Section 640.015, RSMo, all rulemakings that prescribe environmental conditions or standards promulgated by the Department of Natural Resources pursuant to authorities granted in Chapters 640, 260, 278, 319, 444, 643, or 644 shall be based on a Regulatory Impact Report (RIR). This requirement does not apply to rules where the Department Director determines that immediate action is necessary to protect human health, public welfare, or the environment; or to rules of applicable federal agencies adopted by the department without variance.

Upon completion of the comment period, all comments will be reviewed and considered, changes may be made to the RIR or rule text, and comment responses will be provided on the agency web page prior to filing an Order of Rulemaking with the Secretary of State. Contact information is at the end of this RIR.

1. A report on the peer-reviewed scientific data used to commence the rulemaking process.

a. Land application operating permits – Land application of industrial wastewater and industrial wastewater treatment residuals is a method of treatment that uses soils, vegetation, or other agricultural commodities to aid in the removal of nutrients via methods such as soil sorption and plant uptake. This method of treatment can be an effective means of providing Missouri landowners beneficial nutrients for their soils and plants, while also providing wastewater treatment facilities an effective method of nutrient removal. During the formation of this proposed rule amendment, the department reviewed data and literature from numerous sources to aid in rule development.

The proposed rule amendment allows for the land application of industrial wastewater and wastewater treatment residuals. By the draft definition of land application, these materials, when applied on land, must provide some benefit to soils, vegetation, or to a specific agricultural commodity without creating harmful impacts to public health and the environment. To understand the impacts of land applied material, the department reviewed literature from, but not limited to, the University of Missouri's Agricultural Extension Center. Examples of reviewed documents include *Strategies to Minimize Phosphorus Loss From Your Farm* (Lory & Cromley 2018), *Phosphorus Best Management Practices for Biosolids and Other Organic Residuals* (Lory 2018), *The Missouri Phosphorus Index* (Lory et. al 2024), *Managing Manure Phosphorus to Protect Water Quality* (Lory 2018), and *Agricultural Phosphorus and Water Quality* (Lory 2018). This literature included information on the Missouri Phosphorus Index, including how differences in climate, soil type, and crop management can affect localized phosphorus loss to help identify agricultural fields with high potential of nutrient runoff. Literature and data from the University of Missouri's Agricultural Extension Center was also reviewed for information on nutrient loading rates. This literature identified the need to consider both nitrogen-based land application rates and phosphorus-based land application rates to ensure sustainable land management practices aiding crop yield, crop quality, soil health, and minimize nutrient runoff. The Natural Resources Conservation Service's Revised Universal Soil Loss Equation, Version Two (RUSLE2) was also evaluated by the department to determine the equation's effectiveness and use

capabilities for the estimation of soil erosion and nutrient loss on site-specific land application fields.

The proposed rule amendment aims to protect human health and the environment associated with the misapplication and mismanagement of land applied industrial wastewater and wastewater treatment residuals and the fields in which they are applied. To ensure the department was adequately protecting human health and the environment, the department reviewed information and literature from various organizations and sources. This includes information from the United States Environmental Protection Agency, the Centers for Disease Control, the Missouri Department of Health and Senior Services, other state agencies, and a wide variety of peer reviewed literature. This information reviewed included data and literature regarding land application in other states, the health impacts of different chemicals and compounds potentially found in land applied materials, and the possible impacts of land application. More information on the material reviewed by the department as it relates to the human and environmental impacts associated with this rule amendment can be found in sections two and three of this Regulatory Impact Report.

b. Rule Text Revisions – The proposed rule amendment includes revisions to provide clarity in rule, and consistency with the Missouri Clean Water Law, sections 644.016, 644.041, and 644.051, RSMo, effective July 9, 2024.
    1) The removal of definitions. These definitions have been removed from 10 CSR 20-6.015 and will be added in 10 CSR 20-2.010 (Definitions).
    2) The inclusion of new definitions.
        a. A definition for "*land application of wastewater or treatment residual materials*" was created to provide consistency with the Missouri Clean Water Law and to clarify land application is a treatment methodology which must provide a benefit to soils, vegetation, or a specific agricultural commodity.
    3) General rule text revisions to provide clarity of existing regulations.

The proposed rule language amendments listed above improve the clarity and consistency of regulations and did not rely on peer-reviewed scientific data or references to implement the respective rule amendments.

c. Exemptions – A permit exemption for satellite collection systems is established in statute and rule language clarifies that the exemption only applies to satellite systems which do not release, spill, leak, or otherwise discharge wastewater from the system. All wastewater must be properly emitted into a permitted treatment works treating domestic sewage to meet this exemption. Other exemptions were revised to ensure exemptions do not pose adverse risks to human health or the environment.

The proposed rule language amendments listed above clarify the existing rule to ensure permit exemptions do not result in harm to human health or the environment, and to mirror the statutory exemption for satellite sewer systems that do not discharge wastewater other than to a treatment works treating domestic sewage. These revisions did not rely on peer-reviewed scientific data or references to implement the respective rule amendments.

2. A description of persons who will most likely be affected by the proposed rule, including persons that will bear the costs of the proposed rule and persons that will benefit from the proposed rule.

a. This proposed rule amendment requires specific application processes and minimum permit requirements for no-discharge operations and land application sites. Persons affected by this rule are those who wish to land apply industrial wastewater or industrial wastewater treatment residuals and the general public. As the proposed rule amendment applies to the land application of industrial wastewater and wastewater treatment residuals, the proposed rule amendment does not create any additional costs for domestic facilities, either public or privately owned, that land apply their wastewater or wastewater treatment residuals.

Impacts to entities land applying industrial wastewater and wastewater treatment residuals, and entities constructing and operating commingled, offsite open storage basins and open storage vessels, as defined in Section 644.016 RSMo
This proposed rule amendment potentially affects 117 facilities currently holding a Missouri State Operating Permit for land application of industrial wastewater or industrial wastewater treatment residuals as a part of a treatment process. These 117 facilities (**Appendix A**) consist of 89 facilities holding a general permit, and 28 facilities holding a site-specific permit. Land application of these materials has been permitted by the department in the past and, as such, cost estimates will consist solely of new or increased sampling requirements to determine land application field loading rates.

The proposed rule amendment includes setback, sampling, and monitoring requirements for commingled, offsite industrial wastewater or industrial wastewater treatment residuals stored in open storage basins or open storage vessels. Currently, the department is aware of three existing commingled offsite open storage basins or open storage vessels in Missouri that are intended for storing industrial wastewater or treatment residuals. However, two of these basins are not eligible and will not be permitted because they do not meet the newly established statutory setback distances, and one of these basins was previously permitted under a Missouri State Operating Permit.

For the purposes of this RIR, the department is not considering impacts from changes that occurred, and were implemented, independently of this specific proposed rule amendment. Specifically, in 2023, the Missouri Fertilizer Control Board did not renew fertilizer licenses for many materials that had previously been issued fertilizer licenses and were land applied under an exemption from permitting through the Missouri Clean Water Law. This exemption only applies to land application of materials that are licensed fertilizers and are sampled for other potential pollutants. The change in status of these materials in 2023 was based on the Missouri Fertilizer Control Board's decision, not a change in this rule. Even prior to this proposed rule amendment, this rule covered land application of wastewater and wastewater treatment residuals and established the foundation of the department's permitting authorization. Many of the recent costs associated with land application of wastewater and wastewater treatment residuals were incurred as a result of the Missouri Fertilizer Control Board's decision, not a change in the department's permitting of land application of industrial wastewater and wastewater treatment residuals. The department has issued land application permits for over 20 years, which have required development of Land Application Management Plans, operation and maintenance requirements, system monitoring and reporting, material sampling, sludge

sampling, soil sampling, and reporting.[1] As such, this RIR only covers the new or additional requirements associated with the actual proposed amendment and does not analyze or address impacts from the Missouri Fertilizer Control Board's decision.

During RIR development and stakeholder discussions, industry representatives raised concerns about increased transportation costs, specifically that the proposed new requirements might lead to more restrictive land application rates and, therefore, require materials to be transported farther to be land applied at new locations, arguing that these costs should be reflected in the RIR. The department did not include transportation costs associated with this concern in this RIR for the following reasons:

1. Of the nine sources of material land applied by Bub's Incorporated (one of the new large facility permit applicants), only one of the materials is sourced from within the state of Missouri. All other materials are imported into the state and already have significant associated transportation costs to move them from their original sources into Missouri.
2. Of the 101 sources of material previously land applied by Denali Water Solutions LLC (another permit applicant with multiple large facility permit applications) under fertilizer permit exemptions, almost two-thirds of the sources (66 facilities) are located outside of Missouri, which again involves significant transportation costs not caused by this rule amendment.
3. Historically, when these materials were licensed as fertilizers, the companies land applying them submitted permit exemption requests based on the use of the material as a fertilizer and were issued exemptions on the understanding that the materials would be used on agricultural fields with application rates based on soil testing and nutrient requirements. If current soil tests show an excess of nutrients, it is likely because of historical land application practices of applying materials at rates that exceeded the agronomic needs of the field. The permit exemptions clearly required agronomic land application rates and provided guidance on how to prevent overapplication of nutrients. This RIR does not include any analysis of these speculative or hypothetical costs that might be incurred as a result of historical overapplication of materials in excess of agronomic needs.

Impacts to the general public

In addition to those who wish to land apply industrial wastewater and wastewater treatment residuals, the general public is also impacted by this proposed rule amendment. The land application of industrial wastewater and wastewater treatment residuals is a treatment methodology that utilizes soils, vegetation, or other agricultural commodities to manage land applied material. This material, by draft definition, must provide a benefit to soil, vegetation, or other agricultural commodity without harmful impacts to public health and the environment. Industrial wastewater and wastewater treatment residuals can contain vital plant nutrients such as nitrogen and phosphorus. Nitrogen and phosphorus are essential plant nutrients which play a role in a variety of plant functions such as chlorophyll production, photosynthesis and plant respiration, disease resistance, plant growth, and crop yield (Zayed, Omar et al., 2023). In addition to plant benefits, these nutrients can provide other agricultural benefits such as an increased soil health. As land application of industrial wastewater and wastewater treatment residuals can be a source

[1] As a referenced example, please see Missouri State Operating Permit MO-0119580 issued on January 1, 2020, to Gilster-Mary Lee Corporation for land application of industrial wastewater and wastewater treatment residuals. Also please reference historic versions of the MOG-822 master general permit.

of these plant and soil nutrients, the land application of material may lower the costs to agricultural producers incurred through the application of nutrient-rich commercial fertilizers. However, when nutrients are applied to fields in excess, the potential for nutrient runoff increases. This runoff has the potential to enter Waters of the State, as defined by Section 644.016(31) RSMo, and cause eutrophication. Eutrophication is the process in which excess nutrients, primarily nitrogen and phosphorus, enter a waterbody and cause increased algae and plant growth. Eutrophic events may cause numerous waterbody issues including the potential of harmful algal blooms and cyanotoxins impacting recreational activities and aquatic life, and the reduction of dissolved oxygen concentrations which can cause fish kills (Pretty et al., 2003). More information on the numeric costs associated with the over application of nutrients can be found in section three of this RIR. The proposed rule amendment ensures the proper and effective land application operations of facilities that land apply industrial wastewater or industrial wastewater treatment residuals. Specifically, the requirements found within the Industrial Nutrient Management Technical Standard (INMTS) for Wastewater Treatment Residuals and the Land Application Management Plan (LAMP) utilize nutrient loading rate and hydraulic loading rate calculations to ensure nutrients are being applied to fields in beneficial amounts which maximize the level of nutrient treatment and crop uptake, while minimizing the potential of nutrient runoff.

b. The proposed rule amendment includes language to: 1) move definitions from 10 CSR 20-6.015 to 10 CSR 20-2.010 Definitions, 2) create a definition for land application, and 3) add general revisions to rule text to add clarity and consistency. These proposed rule language amendments provide benefits to persons operating no-discharge operations, or persons wishing to perform land application of domestic, non-domestic, or industrial liquids, and/or solids; or hold or comingle such liquids and/or solids through added rule clarity and consistency. These revisions are not anticipated to have negative impacts.

   The proposed rule amendment to the exemptions contained in 10 CSR 20-6.015(3) are intended to: 1) establish an exemption for satellite collection systems that operate as no-discharge systems, 2) modify an existing permit exemption to reflect recent changes already established through legislation and by the Missouri Fertilizer Control Board, and 3) revise exemptions to provide clarity and to ensure permit exemptions do not cause adverse impacts to human health or the environment.

c. Satellite collection systems, when operated and maintained appropriately, should be free from leaks, spills, releases, and other discharges into the environment. These systems convey all wastewater, without release to the environment, to a treatment works treating domestic sewage. Persons impacted by this rule amendment are those who own, operate, and act as the continuing authority of satellite collection systems that convey wastewater from their sewer system to a treatment works treating domestic sewage. As the department is prevented by Section 644.051.2 RSMo from requiring operating permits for satellite systems that are operating properly and discharging all material to another facility, the number of satellite systems in the state is unknown. This permit exemption mirrors the statute and provides clarity for satellite systems, reinforcing that they are not subject to operating permit requirements provided they do not have any discharge of waste into the environment.

These revisions to the exemptions are intended to provide clarity to the existing rule, ensuring permit exemptions do not result in harm to human health or the environment, and to mirror the statutory exemption for satellite sewer systems that do not discharge wastewater other than to a treatment works treating domestic sewage. These changes will not result in adverse impacts to human health or the environment and are not anticipated to have negative impacts.

3. A description of the environmental and economic costs and benefits of the proposed rule amendment.

a. The proposed rule amendment requirements create environmental and economic costs and benefits. Economic costs of new land application requirements contained in 10 CSR 20-6.015 consist of sampling and labor costs for facilities seeking to land apply industrial wastewater or industrial wastewater treatment residuals. These economic costs include the costs of calculating field application loading rates and the costs of open storage basin and open storage vessel sampling requirements. An analysis of both categories of costs follows below:

1) New requirements that would be created by the proposed rule amendment include regular soil sampling to confirm proper land application rates based on agronomic needs for fields in which material is land applied. These loading rates are used to determine the field's capacity to treat pollutants which are applied, and the likelihood of runoff. As proposed, required soil sampling is to be conducted yearly on each field where material will be land applied, with one soil sample required per 80 acres of field. Each soil sample will be a composite of equally distributed soil borings collected from each field. To calculate these costs, the department reviewed the number of facilities with Missouri State Operating Permits that currently utilize land application as a treatment method for industrial wastewater or industrial wastewater treatment residuals (117 facilities). The department then reviewed each impacted facility to determine the total number of land application fields utilized (**Appendix A**). This review yielded a total result of 318 land application fields subject to new soil sampling requirements. Of these 318 land application fields, facilities with general Missouri State Operating Permits had a total of 162 land application fields (Min.= 1, Max. = 18, Average = 1.8), and facilities with site-specific Missouri State Operating Permits had a total of 156 land application fields (Min. = 1, Max. = 60, Avg. = 5.6). For cost estimation purposes, it was assumed that each land application field is 80 acres in size, requiring one soil sample consisting of 80 soil cores (one per acre) to be taken to ensure a representative soil composite. The assumption of each land application field being 80 acres in size is likely an overestimate. Additionally, it was assumed that operators conducting this soil sampling make $50,000 per year, at $24.00 an hour, with soil sampling requiring 15 hours ($360.00) of operator time over one 80-acre field. This 15-hour soil sampling estimate was based on the assumption that each soil core would take approximately 11 minutes to collect.

Table A. Estimated Annual Soil Sampling Cost to Determine Annual Loading Rates

Estimated Annual Cost of Soil Testing to Determine Annual Loading Rates				
# of General Permit Facilities	**# of Land Application Fields**	**Cost/Soil Sample****	**Operator Labor**	**Total*,****
89	**162**	**$15.00**	**$360.00**	**$60,750.00**
# of Site-Specific Facilities	**# of Land Application Fields**	**Cost/Soil Sample****	**Operator Labor**	**Total*,*****
28	**156**	**$15.00**	**$360.00**	**$58,500.00**
Estimated Total Annual Costs to Determine Annual Loading Rates				**$119,250.00**

* Total = (# oooo lllllll llaaaallaaaallaaaaooll ooaafllllff) ∗ (CCooffaa oooo ffooaall fflssaallaallss + LLllLLooLL)

** Average annual cost per general permitted facility = $682.58

*** Average annual cost per site-specific permitted facility = $2,089.29

**** Soil sampling costs based on selecting the soil analysis method through the University of Missouri Agricultural Soil Laboratory (**Appendix B**).

2) The proposed rule amendment includes requirements that create costs for owners of commingled offsite industrial wastewater or treatment residuals stored in open storage basins or open storage vessels. These facilities, per the newly established definitions in Section 644.016 RSMo, have a capacity of more than 2.5 million gallons. Currently, there are three open storage basins in Missouri that meet this definition: Denali Water Solutions LLC-Callao, Denali Water Solutions LLC-Evans, and Denali Water Solutions LLC-Gideon. The proposed rule amendments require a minimum of annual sampling, with increased frequency based on material variability in accordance with the INMTS, of the material from these basins and vessels to be land applied. Specifically, sampling requirements include sampling for arsenic, aluminum, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, thallium, *E. coli*, fecal coliform, and salmonella. For conservative cost estimation purposes, it was assumed that facilities would have monthly sampling frequencies due to variability of land applied material. Additionally, it was assumed that operators conducting sampling make $50,000 per year, at $24.00 an hour, with samples requiring 0.5 hours ($12.00) of operator time.

Table B. Estimated Annual Costs for Sampling Open Storage Basins and Vessels

Estimated Annual Costs of Open Storage Basin/Vessel Sampling				
All Metals**	***E. coli* & Fecal Coliform**	**Salmonella**	**Operator Labor**	**Annual Total***
$258.00	**$63.00**	**$55.00**	**$12.00**	**$4,656.00**
Cost X 3 = Estimated Total Annual Costs for all Missouri Open Storage Basins/Vessels				**$13,968.00**

* Annual Total = (∑ Costs) ∗ 12 ssoollaahff

Annual total assumes monthly sampling of open storage basis and vessels due to assumed variability of the material in accordance with the INMTS.

** All metals include: arsenic, aluminum, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, and thallium per Section 644.051.8 RSMo.

Currently, industrial process wastewater and industrial process wastewater residuals are subject to Missouri State Operating Permit monitoring and sampling requirements prior to entering an open storage basin or open storage vessel. This sampling provides information to the facility, the department, and the general public on what is entering an open storage basin or vessel. However, as material is commingled, a possibility of chemical reactions and volatilization exists due to a variety of factors including varying

chemical constituents of source material which may react with other compounds found in other source material, varying temperatures, varying fat and lipids content, and varying bacterial loading and dissolved oxygen content. These reactions of commingled materials may alter the chemical constituents within the basin or vessel. As such, sampling is needed to accurately identify and quantify what is being held in an open storage basin or vessel prior to land application. This testing allows the department to ensure land application procedures do not cause adverse environmental or human health impacts.

At the time of this report, the department has developed draft Missouri State Operating Permits for large, currently unpermitted, facilities wishing to land apply industrial wastewater and industrial wastewater treatment residuals as a method of treatment. The department evaluated these facilities to determine the amount and size of proposed land application fields. The largest of these facilities has 84 land application fields, 21 of which are over 80 acres in size and would require additional monitoring and sampling. Of the 21 fields greater than 80 acres, two fields are greater than 160 acres in size. For cost estimation purposes, the department calculated an estimated cost for these large facilities wishing to land apply industrial wastewater and industrial wastewater treatment residuals by utilizing values derived from the permit application of the largest facility. For purposes of this analysis, it was assumed that operators conducting monitoring and testing make $50,000 per year, at $24.00 an hour. For estimating the annual cost for calculating field loading rates the department assumed that each large facility has 107 80-acre land application fields, with each 80-acre field requiring one soil sample consisting of 80 soil cores (one per acre) each to ensure a representative soil composite. This 107-field estimate was derived from a reviewed Missouri State Operating Permit application which contained 84 land application fields, with 21 fields greater than 80 acres, and two fields greater than 160 acres. Soil sampling has been estimated to take 15 hours ($360.00) of operator time per field. This 15-hour soil sampling estimate was based on the assumption that each soil core would take approximately 11 minutes to collect. These assumptions result in an overestimation, as not all land application fields are 80 aces in size. However, this approach was utilized to develop a conservative cost estimate for this sampling.

Table C. Estimated Annual Cost for Large Land Application Facilities

Estimated Annual Costs for Calculating Field Loading Rate			
# of Application Fields	**Cost/Soil Sample**	**Cost of Labor**	**Total***
107	**$15.00**	**$360.00**	**$40,125.00**
Estimated Annual Costs of Source Material Monitoring			
# of Source Material	**Cost/Fecal Coliform Sample**	**Cost of Labor**	**Total***
138	**$32.00**	**$12.00**	**$6,072.00**
		Total Estimated Cost per Large Facility	**$46,197.00**
		Cost X 10 = Total Estimated Costs for all Large Facilities	**$461,970.00**

* Total = (# *oooo llaaaallaaaallaaaaooll ooaaffllllff* $*$ ($\sum$ Costs))

** Total = (# *oooo ffoossLLaaff ssllaaffLLaallll* $*$ ($\sum$ Costs))

Costs for land application of these materials prior to this proposed rule amendment effort are not included in the RIR estimates. Please see the discussions above explaining what costs have been discussed during the RIR development but have not been included in this RIR as they are not costs associated with this proposed rule amendment.

Environmental costs and benefits, and economic costs to the general public

The field loading based land application rates established in rule create both environmental and economic benefits through the reduction of nutrient runoff. Industrial wastewater and wastewater treatment residuals may contain plant nutrients that, when land applied on a field under agronomic rates, provide plants with vital nutrients needed for growth. However, improper land application of industrial wastewater and wastewater treatment plant residuals can result in the overapplication and subsequent runoff of nutrients from the field and into waters of the state. The increase in nutrients entering a waterbody through runoff has the potential to cause eutrophication. Eutrophic events may lead to an increase in algae growth, the formation of harmful algal blooms and their associated cyanotoxins, a decrease in dissolved oxygen, detrimental impacts on the existing aquatic community, and a reduction of recreational opportunities in and on impacted waterbodies which may hinder local tourism and related economies. Some forms of algae that may dominate eutrophication events, specifically Cyanobacteria, release harmful toxins that can contribute to harmful algal blooms. These toxins, when ingested or inhaled, can result in gastrointestinal illness, liver and kidney damage, fever, and the death of livestock, wildlife, and pets. In Missouri, these harmful algal blooms have resulted in the closure of swimming beaches and other recreational activities in Missouri's waterbodies. Closure of Missouri's waterbodies due to harmful algal blooms may result in a loss of revenue for the community when boating, fishing, and swimming are not allowed or recommended. These recreational activities support fueling, dining, and shopping on and around the waterbodies where recreation activities occur.

During eutrophic events, water clarity is reduced. This reduction of water clarity associated with excessive nutrient-caused eutrophic events can impact property owners near or on waterbodies. Several studies have indicated that increased water clarity associated with nutrient reduction is a significant factor in raising the value of such properties (Michael et al., 1996; Wilson and Carpenter 1999). Steinnes (1992) found an average increased value of $235 per lakeshore lot for each 1 meter (m) increase in water transparency as measured with a Secchi disk. Conversely, numerous studies have demonstrated that the reduced water clarity associated with excessive nutrient loading have resulted in a wide range of losses of home values (U.S. EPA, 2015). Krysel et al. (2003) analyzed more than 1,200 lakeshore property sales in northern Minnesota that occurred between 1996 and 2001. Water clarity was a significant explanatory variable for lakeshore property prices. A loss of 1 m in Secchi depth could result in losses of up to $80,000 sales value in an individual lot. Kashian and Kasper (2010) found a decrease of $128 to $402 in the value per shoreline foot in Wisconsin lakes that had high algae blooms, when compared with nearby lakes that did not have this problem. Additionally, a decrease in water clarity brought on by excess nutrient related eutrophication can impact economic beneficiaries that are reliant on tourism-related stream and lake recreation such as restaurants, hotels, and marinas, as well as gas stations both near to and on the way to or from resort areas. Several studies demonstrated relationships between lake water clarity and levels of tourist recreation (Bouwes and Schneider, 1979; Ribaudo and Epp, 1984; Smith et al., 1986; Wilson and Carpenter, 1999). Protected and enhanced water clarity will maintain and improve opportunities for whole body contact recreation.

Additionally, while some sport fishing potential is enhanced with higher nutrient loading, the potential for greater aquatic biodiversity tends to increase with reduced nutrient loading (Egertson and Downing, 2004).

In addition to impacts the aquatic life, recreation, tourism, and local economies associated with nutrient caused eutrophication, citizens that rely on public drinking water systems may also be impacted. Drinking water systems that rely on source water that is impacted by an influx of nutrients and algae may have to increase treatment due to the increase of organic matter, nutrients, and taste and odor problems. This increase in treatment costs are likely passed onto local rate payers.

Additionally, while land application can serve as an effective means of providing Missouri landowners beneficial nutrients for their soils and plants while also providing wastewater treatment facilities an effective method of nutrient treatment and removal, improper land application rates may cause an overapplication of primary nutrients (i.e., nitrogen and phosphorus). This overapplication can lead to nutrient imbalances which may hinder flower and fruit production, produce excess foliage, and inhibit plant uptake of micronutrients such as iron and zinc. Utilizing field loading based land application rates may prevent nutrient imbalances and lead to an increase in crop production and crop yield, effectively aid in nutrient removal, and lower the possibility of nutrient runoff.

b. No significant economic and environmental costs or benefits are expected to result from the rule language amendments which provide clarity and consistency to rule language.

c. Revisions to the exemptions portion of the proposed rule amendment are intended to clarify the existing rule to ensure permit exemptions do not result in harm to human health or the environment, and to mirror the statutory exemption for satellite sewer systems that do not discharge wastewater other than to a treatment works treating domestic sewage. These revisions are not anticipated to create economic or environmental costs or benefits, as these revisions clarify the department's responsibility to ensure any discharge to waters of the state do not pose risks to human health or the environment. These revisions do not create or change the responsibilities and duties of the department and permittees, and do not create any new costs or benefits.

4. The probable costs to the agency and to any other agency of the implementation and enforcement of the proposed rule amendment and any anticipated effect on state revenue.

a. Existing facilities impacted by this proposed rule amendment are currently regulated and permitted by the department. Department staff draft state operating permits, conduct inspections, provide compliance assistance, and pursue enforcement of these facilities for non-compliance.

For facilities currently operating under a Missouri State Operating Permit with existing land application requirements, review of permit applications, proposed land application rates, and sample results for nutrients, metals, and other pollutants is currently conducted by department personnel during the existing application review process. Additionally, the department has historically reviewed Land Application Management Plans to ensure proper land application procedures are conducted (**Appendix C**). As such, review of material required by rule amendments are not anticipated to create or pose a significant new burden to the department.

The new requirements discussed in section three of this report will require department permit writers and inspectors review the applications, permit requirements, sampling data, and land application practices for each large facility contained in **Table C**. At the time of this RIR, these large land application facilities have consumed significant staff time (permit writers and inspectors) as facilities have already submitted permit applications for review. As such, the actual additional costs of permitting these facilities is likely to be negligible. However, the time anticipated to be expended by the department to review these permit applications and associated materials has been estimated to be approximately 20 hours per facility per year (with permits and inspections on a 5-year rotation) after initial permitting. Based on the average cost per hour of $49.69 for an Environmental Assistant/Analyst (permit writer or inspector), and an estimated 10 large land application facilities, the annual cost to the department is anticipated to be $9,938.00. Because similarly situated facilities are already permitted by the department and have an established permit fee and permit applications, no new income is expected to be added to state revenue.

b. Revisions to add clarity and consistency to the proposed rule are not anticipated to increase state revenue or fees, and are not anticipated to impact the department or other state agencies.

c. Revisions to the exemptions portion of the rule clarify the existing rule to ensure permit exemptions do not result in harm to human health or the environment, and to mirror the statutory exemption for satellite sewer systems that do not discharge wastewater other than to a treatment works treating domestic sewage. These revisions are not anticipated to create economic or environmental costs or benefits, as these revisions clarify the department's responsibility to ensure any discharge to waters of the state do not pose risks to human health or the environment. These revisions do not create or change the responsibilities and duties of the department and are not anticipated to impact the department or other state agency.

5. A comparison of the probable costs and benefits of the proposed rule amendment to the probable costs and benefits of inaction, which includes both economic and environmental costs and benefits.

a. The probable costs and benefits of the proposed rule amendments are listed above. The proposed rule amendment is in response to recent revisions to the Missouri Clean Water Law, Sections 644.016, 644.041, and 644.051, RSMo, effective July 9, 2024. These revisions to state statute were deemed necessary by the Missouri Legislature to protect the public and environmental health, welfare, peace, and safety. Inaction to amend 10 CSR 20-6.015 would fail to satisfy the requirements established in House Bill 2134/1956 (2024), while also failing to provide consistency between department regulations and the Missouri Clean Water Law.

b. Inaction to include revisions that add clarity and consistency to the proposed rule amendment will allow the rule text to remain "as is" and not provide clarity within the rule, or consistency with the Missouri Clean Water Law.

c. Inaction to include amendments to the exemptions portion of the rule will allow rule text to remain "as is" and not provide clarity within the rule.

6. A determination of whether there are less costly or less intrusive methods for achieving the proposed rule.

a. The proposed rule amendment is in response to recent revisions to the Missouri Clean Water Law, Sections 644.016, 644.041, and 644.051, RSMo, effective July 9, 2024. This proposed rule amendment is an effort by the department to meet the requirements of the Missouri Clean Water Law. The department is aware that land application of industrial wastewater and wastewater treatment residuals is not the only option for the treatment of these materials. Current department regulations also authorize the discharge of treated wastewater and the pumping and hauling of wastewater and wastewater treatment residuals. The proposed rule amendment details the requirements for continued land application of wastewater and wastewater treatment residuals, and the costs of the proposed rule amendment has been estimated above in **Tables A** though **C**. However, due to the possibility of treatment alternatives to land application (discharge and pump and haul) the department has estimated the costs of these alternatives below.

Treating industrial wastewater and wastewater treatment residuals to meet discharge standards could be very costly, especially treatment of large volumes of high-strength industrial wastewater and wastewater treatment residuals from facilities such as those outlined in **Table C**. Additionally, many of the materials managed through land application are the wastewater and treatment residuals from meat and food processing facilities that currently have wastewater treatment capability but not at the level required for these materials. Within the last calendar year, the department has reviewed two applications for new and upgraded systems for the treatment and discharge of large volumes of similar wastewater. These costs of upgrading and operating systems to discharge, rather than land apply, is detailed below. These costs provide a range in which large facilities would incur for upgrading a system to discharge, rather than conducting land application as a method of treatment for their industrial wastewater and wastewater treatment residual.

Facility 1

- Flow = 350,000 gallons per day
- Calculated Costs for installation of Sequencing batch Reactor and Pretreatment = 7.6 million ($21.71 per gallon)

Facility 2

- Flow = 3,500,000 gallons per day
- Calculated costs for treatment of meat processor and domestic wastewater = 141 million ($40.29 per gallon)

Assuming each of the 10 large facilities outlined in **Table D** above would have the same flows as Facility 1 or 2 listed above, and thus incur the same costs as Facility 1 or 2 listed above, total costs to construct and operate a dedicated, discharging wastewater treatment plant in lieu of land applying these materials equates to $76 million to $1.41 billion in construction. These costs do not include the costs of the hauling or treatment of sludge and treatment residuals. These significant financial investments are largely offset or removed through the land application options proposed within this rule amendment.

Another option for the management of industrial wastewater and wastewater treatment

residuals, especially for the 117 smaller facilities listed in **Table A** and **Appendix A**, is pumping and hauling the material(s) to a permitted wastewater treatment facility for treatment or disposal. Pumping and hauling industrial wastewater and wastewater treatment residuals involves the costs of transportation and for the treatment of the material(s) charged by the receiving facility. Those alternative costs, which are largely offset or removed through the land application requirements proposed within this rule amendment, are provided below. Costs were calculated under the assumption that each MOG22 and MOG822 general permit is operating under the maximum flow allowed under the general permit (50,000 gallons per day for each of the 59 MOG-22 permits, and 10,000 gallons per day for each of the 18 MOG-822 permits). The flow from the other 41 permits (12 general permits and 28 site specific permits) were calculated using the permitted design flow entered in the Missouri Clean Water Information System (MOCWIS). Additionally, it was assumed that the costs for pumping and hauling material(s) is $200.00 per every 2,000 gallons pumped and hauled, or $0.10 per every gallon. This cost was estimated by reviewing previous agreements between facilities pumping and hauling and the receiving facility. Please note, these costs do not necessarily include the hauling and transportation rate associated with the pump-and-haul activities, and charges may vary dependent on the constituents of the wastewater or wastewater treatment residuals. In short, these costs likely represent only a fraction of the true cost for a facility to pump and haul, rather than use the land application options proposed within this rule amendment.

Table D. Estimated Annual Cost for Pump And Haul (alternative if land application is not available)

Estimated Annual Costs of Pump and Hauling (MOG-22 and MOG-822)			
Facility Type	**Design Flow (gallons)**	**Cost per Gallon ($)**	**Total***
59 MOG22	50,000	$0.10	$295,000.00
18 MOG 822	10,000		$18,000.00
Estimated Annual Costs of Pump and Hauling (Non-MOG-22 and Non-MOG-822)			
Facility Type	**Total Permitted Design Flow (gallons)**	**Cost per Gallon ($)**	**Total****
28 Site Specific Permits and 12 General Permits	97,366,712	$0.10	$9,736,671.00
Total Estimated Costs for Pump and Haul:			$10,049,671.00

* Total = *FFllaaaallaaaaFF aaFFaaff * DDffffaassll FFllooFF * CCooffaa aaffLL GGllllllooll*

** Total = *TTooaallll PPffLLssaaaaaaffll DDffffaassll FFllooFF * CCooffaa aaffLL GGllllllooll*

After the review of the alternatives detailed in above, the department has concluded that there are no less costly or intrusive alternatives available to achieve the goals of the proposed rule as the alternative costs were shown to be significantly higher than the costs of land application.

b. The proposed rule amendments improve the clarity and consistency of regulations. As such, no less costly or intrusive methods for achieving the desired improvements were found.

c. The proposed rule language amendments listed above clarify the existing rule to ensure permit exemptions do not result in harm to human health or the environment, and to mirror the statutory exemption for satellite sewer systems that do not discharge

wastewater other than to a treatment works treating domestic sewage. These revisions clarify the department's responsibility to ensure any discharge to waters of the state do not pose risks to human health or the environment. As such, no less costly or intrusive methods for achieving the desired affects were found.

7. A description of any alternative method for achieving the purpose of the proposed rule that were seriously considered by the department and the reasons why they were rejected in favor of the proposed rule.

a. The proposed rule amendment is in response to recent revisions to the Missouri Clean Water Law, Sections 644.016, 644.041, and 644.051, RSMo, effective July 9, 2024. These revisions were introduced in House Bill 2134/1956 (2024) with an emergency clause stating, "immediate action is necessary to protect the health of Missourians living near certain industrial wastewater facilities and to protect the environment from the release of pollution [the revision to the Missouri Clean Water Law] is deemed necessary for the immediate preservation of the public health, welfare, peace, and safety…". One alternative considered to the proposed rule amendment was requiring in-soil sampling of PFOS, PFOA, PFHxS, and PFNA in the INMTS. However, PFAS were not included in the text of the law. As this is a compound for which the regulations, safety thresholds, chemistry, and toxicity are still emerging, the department opted to defer PFAS regulations at this time, until the science and federal regulations are more thoroughly documented and established. As such, the department opted for the least restrictive alternative, which is not regulating PFAS.

b. No alternative methods or rule language were considered to the proposed rule amendments to provide clarity and consistency to rule.

c. No alternative methods or rule language were considered to the proposed rule amendments to clarify the department's responsibility to ensure any discharge to waters of the state do not pose human or environmental risks.

8. An analysis of both short-term and long-term consequences of the proposed rule.

a. Short-term consequences of the proposed rule amendment include compliance with requirements of the Missouri Clean Water Law, Sections 644.016, 644.041, and 644.051, RSMo, effective July 9, 2024.

Long-term consequences of the proposed rule amendment include the assurance of responsible and effective land application of industrial wastewater and industrial wastewater treatment residuals. Requirements of the rule amendments include the incorporation and adoption of best management practices and appropriate loading rates to prevent nutrient runoff, plant toxicity, and environmental degradation. Possible effects of reduced nutrient runoff include a decline in eutrophication events, improving the protection of aquatic life and human health in Missouri. Additional long-term consequences include the protection of human health and groundwater sources via the increased monitoring, sampling, and setback requirements of commingled offsite industrial wastewater or treatment residuals stored in open storage basins or open storage vessels.

b. The short and long-term consequences of the proposed rule text amendments are

additional clarity and consistency in the regulation which will make for more efficient and effective implementation and application of the rule.

c. The short and long-term consequences of the proposed rule amendments include clarity to the existing rule to ensure permit exemptions do not result in harm to human health or the environment, and to mirror the statutory exemption for satellite sewer systems that do not discharge wastewater other than to a treatment works treating domestic sewage. These revisions clarify the department's responsibility to ensure any discharge to waters of the state do not pose risks to human health or the environment.

9. An explanation of the risks to human health, public welfare or the environment addressed by the proposed rule.

a. Improper land application can pose a variety of risks to human health and the environment, including nutrient runoff leading to eutrophication and harmful algal blooms, the introduction of pollutants in amounts causing poor soil health and phytotoxicity, and an increase in pathogen quantity. While the department has historically regulated land application practices through the permitting process, the proposed rule amendment promulgates requirements for these facilities and operations directly into rule. The proposed rule amendment establishes a framework for the protocols and methods facilities should utilize when determining the form, source, amount, timing, and method of application of these materials on individual land application fields. The proposed rule amendment also establishes an outline of the minimum permit conditions for land application facilities such as sampling requirements, and when land application is an appropriate form of treatment. These requirements establish proper land application procedures to ensure the protection of soils, crops, surface waters, groundwater, public health, and the environment.

The proposed rule amendment also sets requirements for commingled, offsite industrial wastewater or treatment residuals stored in open storage basins or open storage vessels. These open storage basins and vessels hold commingled industrial waste prior to land application. The proposed rule amendment places new requirements on these structures which include setback distance requirements between the open structure and any public building or residence, and requirements on sampling and monitoring. Setback requirements ensure that commingled, offsite industrial wastewater or treatment residuals stored in open storage basins or open storage vessels are at least one thousand feet from any public building or occupied residence. These setback distances are designed to ensure the public is not within close proximity to these storage basins, reducing the potential for human contact with the commingled industrial waste or its odors. Sampling and groundwater monitoring requirements established in the proposed rule amendment ensure the storage basins and vessels are being sampled, at a minimum, monthly for arsenic, aluminum, barium, cadmium, chromium, copper, lead, mercury, selenium, thallium, *E. coli*, fecal coliform, salmonella, and any other pollutant as determined by the department. These requirements allow the department and general public to understand what is contained in the storage basins or vessels and to ensure proper land application of the material to prevent harm to human health and the environment.

b. The rule text amendments that provide clarity and consistency reduce the risk of misinterpretation or application of the proposed rule. This in turn should reduce risks to human health, public welfare, and the environment.

c. Rule amendments to the exemptions in 10 CSR 20-6.015(3) clarify the existing rule to ensure permit exemptions do not result in harm to human health or the environment, and to mirror the statutory exemption for satellite sewer systems that do not discharge wastewater other than to a treatment works treating domestic sewage. These revisions clarify the department's responsibility to ensure any discharge to waters of the state do not pose risks to human health or the environment.

10. The identification of the sources of scientific information used in evaluating the risk and a summary of such information.

a. Since its creation in 1914, the University of Missouri Agricultural Extension has conducted agricultural research and provided technical resources to help improve and drive agricultural productivity and improve the quality of life in rural America. Research has been conducted on topics such as best management practices, crop management practices, and field nutrient loading. In the development of this rule amendment, the department reviewed research and technical information developed by the University of Missouri Agricultural Extension to evaluate nitrogen and phosphorus nutrient loading rates and the applicability of the Missouri Phosphorus Index in the estimation of crop nutrient uptake and nutrient runoff. Additionally, the department relied on technical information provided by the University of Missouri Agricultural Extension and the U.S. Department of Agriculture's Natural Resources Conservation Service to evaluate the RUSLE2 model to quantify soil and nutrient runoff estimates. Research and technical information provided from the U.S. Environmental Protection Agency and the Interstate Technology & Regulatory Council was also analyzed by the department to evaluate human and environmental health impacts of land application, including the impacts of nutrient runoff, metals and pathogen concentrations in land applied material. Furthermore, the department reviewed current Missouri State Operating Permits to determine the number of facilities (n = 117) currently utilizing land application as a treatment method for industrial wastewater or industrial wastewater treatment residuals allowing the department to assess the number of impacted facilities. Missouri's code of state regulations, and the information utilized to develop the July 9, 2024, revisions to the Missouri Clean Water Law were also reviewed to ensure the proposed rule amendment was consistent with current Missouri regulations, and the goals behind the Missouri Clean Water Law revisions.

b. As noted previously, the proposed rule language amendments improve clarity and consistency of regulations and did not need to rely on peer-reviewed scientific data or references to implement the respective rule amendments.

c. As noted previously, the proposed rule amendments ensure permit exemptions do not result in harm to human health or the environment, and to mirror the statutory exemption for sewer satellite systems that do not discharge wastewater other than to a treatment works treating domestic sewage. These revisions did not rely on peer-reviewed scientific data or references to implement the respective rule amendments.

11. A description and impact statement of any uncertainties and assumptions made in conducting the analysis on the resulting risk estimate.

a. Nutrient and hydraulic loading rates were assumed to have an impact on nutrient runoff, in turn impacting eutrophication, algal growth, dissolved oxygen content, and the size and composition of aquatic communities. However, nutrient reduction alone does not have a defined, consistent, or direct impact on these factors. Other factors such as water temperature, water movement (reaeration), sunlight, sediment, solids, pH, mineral content, other pollutants, and many other considerations can impact water quality. Reduction of nutrients in some water bodies may have a dramatic and noticeable effect, while the impact in other water bodies may be less noticeable or quantifiable. Similarly, it was assumed that improper land application processes can lead to poor soil health and plant toxicity, and the over application of primary nutrients (nitrogen and phosphorus) can lead to nutrient imbalances. These imbalances can hinder flower and fruit production, produce excess foliage, and inhibit plant uptake of micronutrients such as iron and zinc (https://agrilifeextension.tamu.edu/asset-external/phosphorus-too-much-and-plants-may-suffer/). While excess or improper nutrient application can impact soil health and plant toxicity, other factors such as soil composition, soil porosity and compaction, soil organisms and biology, sunlight intensity, climate, pests, and watering can all impact soil and plant health.

   Assumptions were also made regarding the risk assessment of commingled, offsite industrial wastewater or treatment residuals stored in open storage basins or open storage vessels. For the purposes of this assessment, the department assumed unpermitted open storage basins or vessels may pose nuisance or threat to the public, as well as human and environmental risks of the chemical constituents of the commingled material held in the structure. Setback distances were established in accordance with the Missouri Clean Water Law to reduce the public's exposure to these materials. While exposure may occur through the improper maintenance of the basins or vessels, it is assumed rule amendments will adequately protect human health and the environment provided operation and maintenance of these basins and vessels are in accordance with the established and approved Missouri State Operating Permit requirements.

b. As noted previously, the proposed rule language amendments improve clarity and consistency and did not involve uncertainties or assumptions in the calculation of risk.

c. As noted previously, the proposed rule language amendments ensure permit exemptions do not result in harm to human health or the environment, and to mirror the statutory exemption for satellite sewer systems that do not discharge wastewater other than to a treatment works treating domestic sewage. These revisions did not involve any uncertainties or assumptions in the calculation of risk.

12. A description of any significant countervailing risks that may be caused by the proposed rule.

a. Other than economic impacts of increased monitoring and sampling of wastewater and wastewater treatment residuals, no other countervailing risks were identified.

b. As noted previously, the proposed rule language amendments improve clarity and consistency and did not involve any uncertainties or assumptions in the calculation of risk. Therefore, there are no countervailing risks that may be caused by the proposed rule amendment.

c. As noted previously, the proposed rule language amendments ensure permit exemptions do not result in harm to human health or the environment, and to mirror the statutory exemption for satellite sewer systems that do not discharge wastewater other than to a treatment works treating domestic sewage. These revisions did not involve any uncertainties or assumptions in the calculation of risk. Therefore, there are no countervailing risks that may be caused by the proposed rule amendment.

13. The identification of at least one, if any, alternative regulatory approaches that will produce comparable human health, public welfare, or environmental outcomes.

a. The proposed rule amendment is in response to recent revisions to the Missouri Clean Water Law, Sections 644.016, 644.041, and 644.051, RSMo, effective July 9, 2024. These revisions were introduced in House Bill 2134/1956 (2024) with an emergency clause stating, "immediate action is necessary to protect the health of Missourians living near certain industrial wastewater facilities and to protect the environment from the release of pollution [the revision to the Missouri Clean Water Law] is deemed necessary for the immediate preservation of the public health, welfare, peace, safety…". No alternative regulatory approach was identified to comply with the provisions of the Missouri Clean Water Law.

b. The department did not identify any alternative approach to the proposed rule text amendment that would produce comparable human health, public welfare, or environmental outcomes.

c. The department did not identify any alternative approach to the proposed rule text amendments that would produce comparable human health, public welfare, or environmental outcomes.

Comments can be provided on either the RIR or the draft rule text by sending them to the contact listed below or on the web site https://apps5.mo.gov/proposed-rules/welcome.action#OPEN during the RIR comment period:

Missouri Department of Natural Resources
Water Protection Program
ATTN: Susan Mills
P.O. Box 176
Jefferson City, MO 65102-0176

or

Missouri Clean Water Commission
ATTN: Krista Welschmeyer
P.O. Box 176
Jefferson City, MO 65102-0176

or call: 573-751-1300

Copies of the comments made on either the RIR or the draft rule text may be obtained by request from the contact listed above or by accessing the Rules In Development section on the web site https://apps5.mo.gov/proposed-rules/welcome.action#OPEN for this particular proposed rule amendment.

Appendix A: Affected Facility with Permitted Land Application Fields

Permit Number	Land Application Field (count)
MO0106852	2
MO0131059	6
MO0002828	19
MO0103675	2
MO0108952	2
MO0109789	1
MO0113671	1
MO0115061	18
MO0116874	1
MO0118877	1
MO0119580	1
MO0121525	2
MO0121878	1
MO0123447	2
MO0126161	2
MO0128988	2
MO0131342	7
MO0131857	1
MO0135801	3
MO0136450	1
MO0136646	2
MO0136760	60
MO0137669	1
MO0137707	12
MO0138274	1
MO0139297	2
MO0139394	2
MO0139572	1
MOG220030	1
MOG220031	1
MOG220032	1
MOG220035	1
MOG220037	1
MOG220038	1
MOG220042	1
MOG220043	2
MOG220044	2
MOG220049	1
MOG220053	1
MOG220054	1

MOG220055	**1**
MOG220056	**3**
MOG220057	**2**
MOG220059	**1**
MOG220060	**1**
MOG220061	**1**
MOG220062	**1**
MOG220067	**3**
MOG220068	**1**
MOG220069	**1**
MOG220070	**1**
MOG220072	**1**
MOG220073	**1**
MOG220074	**1**
MOG220075	**1**
MOG220076	**1**
MOG220077	**1**
MOG220079	**1**
MOG220080	**1**
MOG220081	**1**
MOG220083	**1**
MOG220084	**1**
MOG220085	**1**
MOG220086	**1**
MOG220087	**1**
MOG220088	**1**
MOG220089	**1**
MOG220090	**1**
MOG220091	**1**
MOG220092	**1**
MOG220093	**7**
MOG220094	**1**
MOG220095	**1**
MOG220097	**1**
MOG220101	**2**
MOG220104	**2**
MOG220109	**1**
MOG220111	**1**
MOG220113	**1**
MOG220115	**5**
MOG220119	**2**
MOG220121	**3**
MOG220122	**1**
MOG220130	**2**
MOG220132	**1**

MOG220133	**2**
MOG220134	**1**
MOG750004	**3**
MOG750013	**1**
MOG750021	**3**
MOG750025	**2**
MOG750029	**2**
MOG750047	**1**
MOG750049	**1**
MOG822145	**1**
MOG822149	**1**
MOG822175	**8**
MOG822176	**1**
MOG822177	**1**
MOG822182	**6**
MOG822196	**3**
MOG822231	**1**
MOG822234	**1**
MOG822247	**7**
MOG822251	**4**
MOG822254	**1**
MOG822258	**1**
MOG822260	**1**
MOG822263	**4**
MOG822324	**18**
MOG822329	**1**
MOG822334	**1**
MOG920007	**1**
MOG920008	**1**
MOG920011	**1**
MOG920012	**1**
MOG920015	**1**

Appendix B: University of Missouri Agricultural Soil Laboratory Analysis Cost

Soil analysis	**Analysis cost**
Regular analysis: pHs, NA, OM, Bray I-P, Ca, Mg, K (includes grinding with recommendations)	$12.50 - for counties and firms with accounts $15.00 - for submitting samples directly to lab
Bray 1-P or Bray II-P (with regular analysis — $4)	$5
Mehlich III or Olson P	$5
pH_w or pH_s (with regular analysis — $3.00)	$5
Neutralizable acidity (NA) and pHs	$6
Sodium (with regular analysis — $2)	$5
Zinc (with regular analysis — $4)	$5
Fe, Cu, Mn (with regular analysis — $4.50)	$6
Zinc, Fe, Cu, Mn (with regular analysis — $7.50)	$8.50
Nitrate (with regular analysis — $4)	$5
Ammonium (with regular analysis — $4)	$5
Nitrate and ammonium (with regular analysis — $8)	$9
Sulfate-Sulfur (with regular analysis — $5)	$6
Boron	$5
Organic matter (OM)	$5
Particle size analysis (percentage sand, silt and clay)	$15
Electrical conductivity	$6
Revise crop recommendations (If requesting to revise recommendations, additional charges will apply)	$2

Appendix C: 2001 Draft Public Notice MO-G822000 Missouri State

Goodin, Arthur
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STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

MISSOURI STATE OPERATING PERMIT

General Operating Permit

In compliance with the Missouri Clean Water Law, (Chapter 644 R.S. Mo. as amended, hereinafter, the Law), and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended,

MO-G822000

is authorized to discharge from the facility described herein, in accordance with the effluent limitations and monitoring requirements as set forth herein:

FACILITY DESCRIPTION

No-Discharge Facility - Sic Code 2011-2099 & 5812
Land Application of wastes from light commercial Food Products Industry Major Group 20 (SIC Codes 2011-2099) and restaurant grease traps (SIC Code 5812) onto agricultural land for use as fertilizer and soil amendment where dry weather design wastewater flows are 10,000 gallons per day or less and are land applied in accordance with an approved Land Application Management Plan that conforms to the Best Management Practices and other requirements contained in the general permit.

This permit authorizes only wastewater, including storm waters, discharges under the Missouri Clean Water Law and the National Pollutant Discharge Elimination System; it does not apply to other regulated areas. This permit may be appealed in accordance with Section 644.051.6 of the Law.

March 23, 2001
Effective Date

Stephen M. Mahfood, Director, Department of Natural Resources
Executive Secretary, Clean Water Commission

March 22, 2006
Expiration Date
MO 780-1481 (7-94)

Director of Staff, Clean Water Commission

DESCRIPTION OF FACILITY

The permittee shall comply with the Land Application Management Plan submitted with the general permit application and with the Land Application Rate Criteria, Best Management Practices and other requirements contained in this general permit. A summary description of the operation is as follows:

Appendix D: Citations

Lory, John A. & Steven Cromley, "University of Missouri" *Strategies to Minimize Phosphorus Loss From Your Farm*, MU Extension, Division of Plant Sciences and Commercial Agriculture Program, Nov 2018, https://extension.missouri.edu/publications/g9220

Lory, John A., "University of Missouri" *Phosphorus Best Management Practices for Biosolids and Other Organic Residuals*, MU Extension, Division of Plant Sciences and Commercial Agriculture Program, Nov 2018, https://extension.missouri.edu/publications/g9183

Lory, John A. et al., "University of Missouri" *The Missouri Phosphorus Index*, MU Extension, May 2024, https://extension.missouri.edu/publications/g9184

Lory, John A., "University of Missouri" *Managing Manure Phosphorus to Protect Water Quality*, MU Extension, Division of Plant Sciences and Commercial Agriculture Program, Nov 2018, https://extension.missouri.edu/publications/g9182

Lory, John A., "University of Missouri" *Agricultural Phosphorus and Water Quality*, MU Extension, Division of Plant Sciences and Commercial Agriculture Program, Nov 2018, https://extension.missouri.edu/publications/g9181

Pretty, J. N., Mason, C. F., Nedwell, D. B., Hine, R. E.m Leaf, S., & Dils, R. (2003). Envionmental costs of freshwater eutrophication in England and Wales *Environmental Science and Technology,* 37(2), 201-208, https://doi.org/10.1021/es020793k

Zayed, Omar et al. 2023. Nitrogen Journey in Plants: From Uptake to Metabolism, Stress Response, and Microbe Interaction. *Biomolecules*, *13*(10), 1443. https://doi.org/10.3390/biom13101443